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Energy Opportunities

HOT WATER, ENERGY AND THE MILKING CENTRE

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Milking centres on dairy farms are some of the largest users of energy in Ontario agriculture. Most of the energy is used to heat the water for cleaning the milk contact surfaces of the milking equipment and the bulk tank.

Bulk tanks are washed usually every second day, and the milking equipment and pipelines usually twice a day. The bulk tanks and milking equipment are cleaned, typically using four cycles: rinse (usually warm water, which is half hot and half cold), wash (hot water), acid rinse (may be warm or cold water) and sanitize (cold water).

VOLUME OF WASHWATER

MSTOR estimates the average volume of water used per day to be 14 L (3.1 gal (imp)) per milking cow for tie stall pipeline systems and 17 L (3.7 gal (imp)) per milking cow for free stall parlours.

Approximately 360,000 cows are milked daily in Ontario[1]. Assuming half of the cows are milked in tie stalls and half in parlours, and using the average volumes of water as estimated above, over 5.5 million L (1.2 million gal (imp.)) of water are used daily in the milking centre (see Table 1, below). Of this volume, approximately 75% is used for maintaining the milking equipment and pipelines[2]; 12% for the bulk tank[2]; and the remainder (13%) for floors, water conditioners, etc. These volumes are assumed to be half hot water and half cold water. Each farm is different, so a particular dairy farm needs to measure its actual volumes to obtain more accurate figures.

TABLE 1. Estimated Volume of Heated Water Used Annually in Ontario

Totals	Number of Milking Cows	Volume of Water L/milking cow/day (gal (imp)/milking cow/day)[2]	% Hot Water[3]	Volume of Hot Water L annually (gal (imp) annually)
In tie stalls	180,000 (tie stall)[1]	180,000 x 14 = 2,520,000 (180,000 x 3.1 = 558,000)	50	1,260,000 x 365 = 459,900,000 (279,000 x 365 = 101,835,000)
In parlours	180,000 (parlour)[1]	180,000 x 17 = 3,060,000 (180,000 x 3.7 = 666,000)	50	1,530,000 x 365 = 558,450,000 (333,000 x 365 = 121,545,000)
In Ontario	360,000 milking cows	5,580,000 L/milking cow/day (1,224,000 gal (imp)/milking cow/day)		1,018,350,000 L (223,380,000 gal (imp))

[1] Assume half milked in tie stalls and half in parlours.
[2] Volumes are used in MSTOR.
[3] Total water used is assumed to be half hot and half cold.

ANNUAL HOT WATER USAGE FOR THE DAIRY INDUSTRY IN ONTARIO

This example, which uses reasonable assumptions as described above, estimates the hot water used annually in Ontario milking centres and the resulting hydro usage, assuming no heat-reclaiming equipment is used. The number of farms that use heat reclaimers is unknown.

ENERGY USAGE FOR THE DAIRY INDUSTRY IN ONTARIO

Well water is usually around 10°C (50°F), and hot water tanks are usually set at about 77°C (170°F). Therefore, heating well water to the proper temperature requires a rise of 77°C – 10°C = 67°C (170°F – 50°F = 120°F).

To heat 1,018,350,000 L of water 67°C requires 79,601,025 kW-h (see endnote[3]). If electricity costs 12 cents per kW-h, the cost is approximately

$9.6 million annually to heat the hot water in all the milking centres in Ontario.

Since there are about 5,100 producers in Ontario[4], this works out to an average of $1,880 per producer annually with an average milking cow herd size of 70 cows[5].

ON-FARM TIPS TO REDUCE ENERGY CONSUMPTION

There are many ways to reduce the energy required to heat water. Listed below are some ideas that producers can investigate further for their operations.

- Have dealer tune up equipment annually.
- Insulate hot water lines.
- Set water heater thermostat to minimum setting that will maintain washwater above 44°C (110°F) during wash cycle as water circulates through pipelines. (If water cools below 44°C, milk fat will come out of suspension and adhere to milk contact surfaces.)
- Add extra insulation to hot water tank.
- Flush sediment from hot water tank on a regular basis.
- Repair dripping water taps.
- Use cold water for cycles whenever possible.
- Install a heat reclaimer.
- Check water temperature regularly.
- Install a water softener, if water is hard.
- Check to ensure top and bottom elements of hot water tank are operating.
- Switch electric water heater to gas or some other form of energy.
- Use recycled washwater to clean floors.
- If teat cups are placed in the wash sink, position them properly to limit water required for proper wash.
- Install air injector to obtain aggressive water slug.
- Investigate availability of water recycling equipment.

ENDNOTES

1. Dairy Farmers of Ontario
2. H. Cuthbertson et al. *Milking Centre Waste Management in Ontario.* CSAE Paper No. 95-513. (Mansonville, QC: CSAE/SCGR, 1995).
3. Equations used:
   (1) heat gained
   = mass of water x specific heat x temperature rise
   = (1,018,350,000 L x 1,000 g/L) x 1 cal/g°C x 67°C
   = 6.82295×10^{13} cal;

   (2) kW-h
   = 6.82295×10^{13} cal x 4.2 joules/cal x 1 kW-h/3,600,000 joules
   = 79,601,025 kW-h
4. Dairy Farmers of Ontario
5. Dairy Farmers of Ontario

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